ALUMINUM

Project Fact Sheet

Effect of Casting Conditions

Benefits

- Potential energy savings of 1,850 billion Btu per year
- Potential cost savings of $45 million per year to the U.S. aluminum industry
- Lower cost aluminum could improve the aluminum industry's competitive position for product applications, foreign competition, and other materials
- Implementation of this technology across the U.S. aluminum industry could result in an annual reduction in greenhouse gases (CO_2) of 43.4 million pounds per year
- Potential reduction of CO, NO_x, and residue environmental releases

Applications

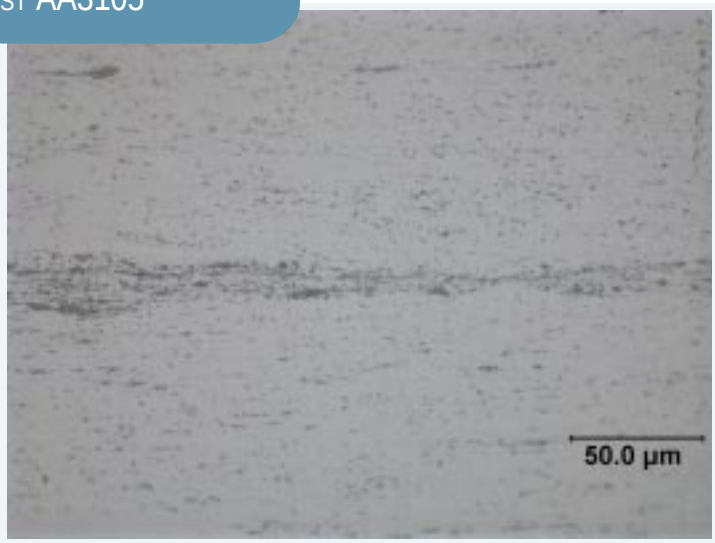
Development of a knowledge base about roll casting these highly alloyed materials will be of great technological, economic, and environmental benefit to the U.S. aluminum industry. These benefits will, in turn, enhance the competitiveness of aluminum sheet products in a variety of product areas such as beverage container ends.

Effect of Casting Conditions and Composition on Microstructural Gradients in Roll Cast Aluminum Alloys

Continuous roll casting of low alloy or unalloyed aluminum has been well established for several decades and has demonstrated energy savings of more than 25 percent relative to ingot rolling. There is great interest in extending this technology to the higher alloy series such as 5xxx and 6xxx to take advantage of the benefits of this process in high alloy products. There are problems with roll casting the high alloy materials due to segregation resulting in microstructural gradients in constituent particles and other characteristics. Currently, very little is known about the relationship between roll cast processing parameters and microstructure properties in these high alloy materials. There is a critical need to better understand these relationships to facilitate production of these materials.

This research is a comprehensive investigation of the effect of roll casting process conditions on the microstructure properties of relatively highly alloyed aluminum. The studies will determine the relationships between roll casting process parameters and the resulting microstructure, annealing response, and properties. In particular, the microstructural analysis will investigate the nature of the microstructural gradients that occur in these materials and the influence of these structures on recrystallization response, crystallographic texture, and formation of cracks during forming. The combined effects of alloying level and casting parameters on the resultant materials will be modeled.

Roll Cast AA3105



Centerline segregation in roll cast AA3105 after cold rolling and recrystallization. Degree of segregation varies with casting speed.

Project Description

Goals: The primary goal of this research is to experimentally determine and model the relationships between roll casting variables and the resultant gradient microstructure in highly alloyed aluminum. Another goal is to understand the effects of casting conditions and constitute particle structure on annealing behavior and the aluminum's tendency to crack during formation.

Progress and Milestones

This research aims to determine and model relationships between processing and material properties and behavior. The tasks necessary to achieve the goals are as follows:

- Develop matrix of alloy compositions and roll cast conditions to be examined;
- Produce roll cast materials throughout the program for investigation of different aspects of processing and composition;
- Evaluate the microstructural gradients of constituent particles and their size distributions;
- Study the recrystallization response as a function of alloy and treatment as well as spatial location within the roll cast material;
- Develop a model to predict the occurrence of cracks as a function of the microstructure;
- Investigate cracking tendency during forming using bend testing;
- Perform crystallographic texture analysis of the experimental materials; and
- Develop relationships among the different alloys, roll casting conditions, and physical and microstructural characteristics.

Commercialization Plan

The technology developed within this project will be made available to the aluminum community through journal publications and/or technical presentations. Industry will incorporate this knowledge to facilitate commercialization.

Project Partners

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